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SOME NOTES ON THE INNERVATION OF THE LUNGS.

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[PLATE V.]

The results of this work are given at the present time, and in their incomplete state, for the reason that I shall be unable for some time to pursue the subject further, and also with the hope that what has already been done may be of some value to any one taking up the subject hereafter. This subject was undertaken to determine the mode of termination of the sensory fibers of the lungs. My reasons for assuming the presence of sensory fibers in the lungs are chiefly the following:

1. Cutting of the pneumo-gastric nerves slows or deepens respiration. By gentle irritation of the central ends of the cut nerve, the normal rythm and depth of breathing are re-established. These two facts can only be explained by assuming that there are fibers in the lungs which carry impressions into the brain from which other impulses go out, the artificial stimulation of the cut nerve taking the place of impressions existing in the normal state.

2. Distension of the lungs is followed by an expiratory effort. Collapse or compression by an inspiratory effort.

3. Moderate distension of the lungs causes an acceleration of the pulse. To explain these facts we must again call in the existence of fibers carrying impressions from the lungs to the central nervous system, and thus bringing about these reflexes.

As objects for my studies, I used the lungs of frogs, turtles, newts and salamanders. Staining agents used were carmine, eosine, osmic acid and, principally, chloride of gold. The frog's lungs, as is known, consist of two sacs, having on them primary or secondary

trabeculæ of connective tissue, and these interfere considerably with the thorough tracing out of the course of the nerve fibers. The turtle's lung is even more complex than that of the frog, there being several sets of septa which divide the large primary sacs into numerous smaller compartments. In the salamander's lung we find the best objects to begin our study with. Here the lungs consist of two very much elongated bags, formed of a thin layer of connective tissue, with numerous smooth muscle cells, and covered in by a single layer of epithelial cells. Before removing the lungs from the animal a canula is tied into the heart, and the whole animal freed from blood by washing out with a 7-10 per cent. NaCl. solution. The lungs are then inflated, if collapsed, by passing a fine tube into the short trachea by way of the mouth, then tied up and treated after Ranvier's method for staining with chloride of gold—that is, immersed for from two to four minutes in lemon-juice, rinsed in distilled water, then put into a 1 per cent. gold chloride solution for three to four minutes, and then into a quantity of distilled water containing one to two drops of acetic acid in each cubic centimeter, and exposed to the light until reduction has taken place.

In the lung prepared after this method we find on one side and running longitudinally, the artery; diametrically opposite, the vein; between which are the usual smaller vessels and the capillaries. Coming in with the artery and following this more or less closely, is a large nerve trunk, and from this are given off the finer branches. The points to which I wish to call attention are:

1. Mode of Division.—Nearly all of the finer fibers divide in the manner shown in fig. 1. There is an expansion made up of finely granular matter, with a few coarser granules, and from the corners of this mass the branches are given off. Generally we find two branches, sometimes three, and in a few cases one branch gives off, laterally, the expansion then appearing as a thickening along the course of the nerve.

2. Along the fibers are found smaller cells (fig. 2) the significance of which I do not know, but in general appearance they correspond with the cells pointed out by Ranvier in the nerve fibers of the heart.

3. Occasionally we find a fiber passing off from the main nerve trunk, running parallel with this for some distance, and then returning to it.

4. There are ganglia composed of from two to six cells, some of which cells have only one process, (fig. 3.) The lower fig. 3 represents the main trunk; the slightly shaded space between is occupied by the blood vessel.

5. The fine fibers form a net-work. Some of these fibers terminate in muscle cells, but not all can be so traced.

It remains still to trace out more clearly the endings of the finest fibers; to pursue the course of a fiber coming from a unipolar cell, to determine whether some of the ganglion cells have not such a relation that they could be taken for nerve end cells.

PLATE V.